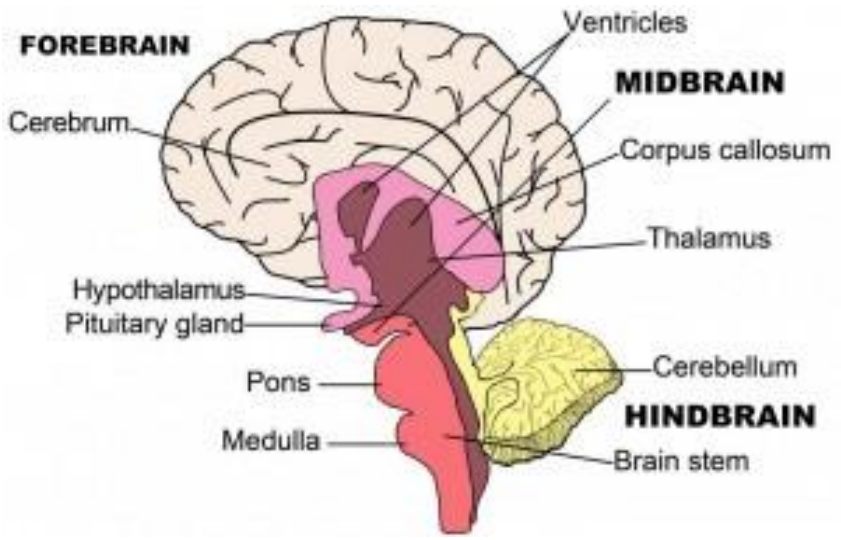
Brain – Structure and Function

The brain structure is composed of three main parts: the **forebrain, midbrain and hindbrain,** each with multiple parts.



Forebrain

It is the anterior part of the brain. The forebrain parts include:

- Cerebrum
- Hypothalamus
- Thalamus
- Limbic System

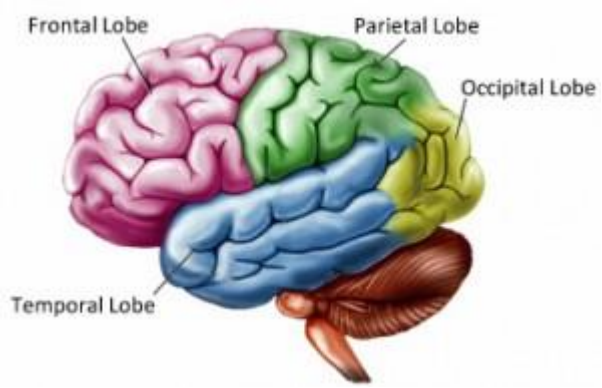
Forebrain Function: Controls the reproductive functions, body temperature, emotions, hunger and sleep.

Fact: The largest among the forebrain parts is the cerebrum. It is also the largest part of all vertebrate brains.

The Cerebrum: Also known as the cerebral cortex, the cerebrum is the largest part of the human brain, and it is associated with higher brain function such as thought and action. Its wrinkled surface increases the surface area, and is a six-layered structure found in mammals, called the neocortex. It is divided into four sections, called “lobes”. They are;

SHOUT
SHARE
IT

the **frontal lobe, the parietal lobe, the occipital lobe** and **the temporal lobe**



Functions of the lobe

Frontal lobe

The frontal lobe lies just beneath our forehead and is associated with our brain's ability to reason, organize, plan, speak, move, make facial expressions, serial task, problem solve, control inhibition, spontaneity, initiate and self-regulate behaviours, pay attention, remember and control emotions.

- Personality, behaviours, emotions
- Judgment, planning, problem solving
- Speech: speaking and writing (Broca's area)
- Body movement (motor strip)
- Intelligence, concentration, self-awareness

Parietal Lobe

The parietal lobe is located at the upper rear of our brain, and controls our complex behaviours, including senses such as vision, touch, body awareness and spatial orientation. It plays important roles in integrating sensory information from various parts of our body, knowledge of numbers and their relations, and in the manipulation of objects. Portions are involved with our visuospatial processing, language comprehension, the ability to construct, body positioning and

movement, neglect/inattention, left-right differentiation and self-awareness/insight.

- Interprets language, words
- Sense of touch, pain, temperature (sensory strip)
- Interprets signals from vision, hearing, motor, sensory and memory
- Spatial and visual perception

Occipital lobe

The occipital lobe is located at the back of our brain, and is associated with our visual processing, such as visual recognition, visual attention, spatial analysis (moving in a 3-D world) and visual perception of body language; such as postures, expressions and gestures.

- Interprets vision (color, light, movement)

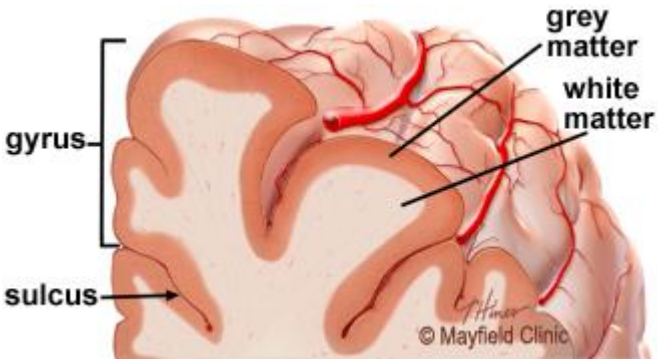
Temporal lobe

The temporal lobe is located near our ears, and is associated with processing our perception and recognition of auditory stimuli (including our ability to focus on one sound among many, like listening to one voice among many at a party), comprehending spoken language, verbal memory, visual memory and language production (including fluency and word-finding), general knowledge and autobiographical memories.

- Understanding language (Wernicke's area)
- Memory
- Hearing
- Sequencing and organization

The brain consists of two types of tissues: grey matter and White matter**.**

1. **Grey matter** mainly consists of various types of cells, which make up the bulk of the brain.
2. **White matter** is primarily composed of axons, which connect various grey matter areas of the brain with each other.



A deep furrow divides the cerebrum into two halves, known as the left and right hemispheres. And, while the two hemispheres look almost symmetrical, each side seems to function differently. **The right hemisphere is considered our creative side, and the left hemisphere is considered our logical side.** A bundle of axons, called the **corpus callosum**, connects the two hemispheres.

In general, the left hemisphere of the brain is responsible for language and speech and is called the "dominant" hemisphere. The right hemisphere plays a large part in interpreting visual information and spatial processing.

- **Broca's area**: lies in the left frontal lobe (Fig 3). If this area is damaged, one may have difficulty moving the tongue or facial muscles to produce the sounds of speech. The person can still read and understand spoken language but has difficulty in speaking and writing
- **Wernicke's area**: lies in the left temporal lobe (Fig 3). Damage to this area causes Wernicke's aphasia. The individual may speak in long sentences that have no meaning, add unnecessary words, and even create new words.

Hypothalamus

The primary role of the hypothalamus is to regulate various functions of the pituitary gland and endocrine activity, as well as somatic functions e.g**.,** Body temperature, sleep, appetite.

Thalamus

The primary role of the thalamus is to relay sensory information from other parts of the brain to the cerebral cortex

Limbic System

The limbic system is often referred to as our "emotional brain", or 'childish brain'. It is found buried within the cerebrum. It helps in maintain internal homeostasis by regulating body temperature, blood pressure and blood sugar level. The limbic system comprises the **Hippocampus and Amygdala**

Hippocampus

The primary role of the hippocampus is memory forming, organizing and storing information. It is particularly important in forming new memories, and connecting emotions and senses, such as smell and sound, to memories.

Amygdala

the primary role of the amygdala is to be a critical processor for the senses. Connected to the hippocampus, it plays a role in emotionally laden memories and contains a huge number of opiate receptor sites that are implicated in rage, fear and sexual feelings.

Mid Brain Smallest and central part of the brain

The midbrain consists of:

- Tectum
- Tegmentum
- Cerebral aqueduct
- Cerebral peduncles
- Several nuclei and fasciculi.

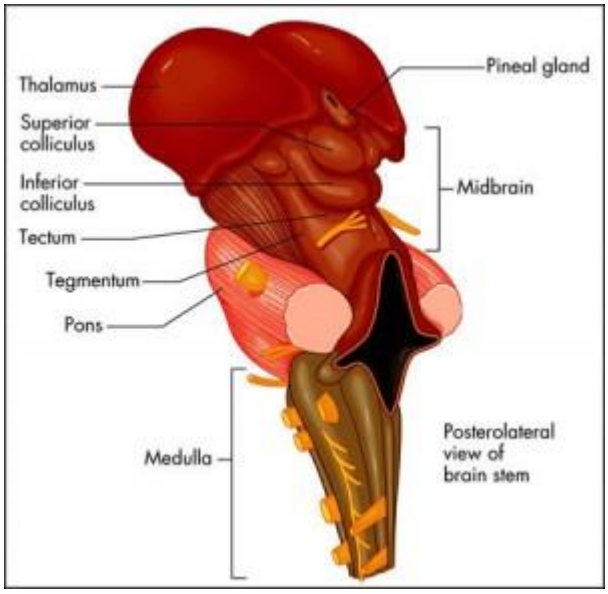
The midbrain is located below the cerebral cortex, and above the hindbrain placing it near the centre of the brain. The primary role of the midbrain is to act as a sort of **relay station for our visual and auditory** systems. Portions of the midbrain called the red nucleus and the substantia nigra are involved in the control of body movement, and contain a large number of dopamine-producing neurons. The degeneration of neurons in the substantia nigra is associated with Parkinson's disease. The midbrain is the smallest region of the brain, and is located most centrally within the cranial cavity.

The Tectum

Tectum is a small portion of the brain, specifically the dorsal part of the midbrain. It serves as a relay centre for the sensory information from the ears to the cerebrum. It also controls the reflex movements of the head, eye and neck muscles. It provides a passage for the different neurons moving in and out of the cerebrum.

Tegmentum

Tegmentum is a region within the brainstem. It is a complex structure with various components, which is mainly involved in body movements, sleep, arousal, attention, and different necessary reflexes. It forms the platform for the midbrain and connects with the thalamus, cerebral cortex and the spinal cord.



Hind Brain: The lower part of the brain

The hindbrain is composed of:

- Cerebellum
- Medulla
- Pons

Cerebellum

The cerebellum, or "little brain", is similar to the cerebrum with its two hemispheres and highly folded surface. It is associated with regulation and coordination of movement, posture, balance and cardiac, respiratory and vasomotor centres.

- It senses equilibrium.
- Transfers information.
- Coordinates eye movement.
- It enables precision control of the voluntary body movements.
- Predicts the future position of the body during a particular movement.
- Both anterior and posterior lobes are concerned with the skeletal movements.
- The cerebellum is also essential for making fine adjustments to motor actions.

- Coordinates and maintains body balance and posture during walking, running, riding, swimming.

Medulla

The primary role of the medulla is regulating our involuntary life sustaining functions such as breathing, swallowing and heart rate. As part of the brain stem, it also helps transfer neural messages to and from the brain and spinal cord. It is located at the junction of the spinal cord and brain.

Pons

The pons is the primary structure of the brain stem present between the midbrain and medulla oblongata. It serves as a relay signal between the lower cerebellum, spinal cord, the midbrain, cerebrum and other higher parts of the brain. The main functions of the pons include:

- Controlling sleep cycles.
- Regulating the magnitude and frequency of the respiration.
- Transfers information between the cerebellum and motor cortex.
- Pons is also involved in sensations, such as the sense of taste, hearing and balance.

Telegram Link - https://t.me/ugcnetpsychologyforall